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AUTHOR	Barker, Thomas B.
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ABSTRACT

There is a wide array of approaches that produce materials (courseware) for the delivery of university level courses via Distance Learning (DL). DL has increasingly become part of university systems across the United States and is expected to grow to 10% of enrollment at the Rochester Institute of Technology (RIT) by the start of the next millennium. RIT has been a pioneer in DL with over 148 DL courses offered each year. With this expected growth of course offerings, strain has begun to take place on production support personnel and facilities at RIT and elsewhere. This study, supported by a Provost Productivity Improvement grant from RIT, set out to point the way to a video lecture production approach that can be accomplished by faculty much in the same manner they produce course materials for conventional classroom delivery. This paper details the effort that went into the planning, execution, and delivery of two courses in the graduate program in applied statistics in the College of Engineering at RIT. The educational effectiveness of these courses is reported by making statistical comparisons with parallel courses taught in the conventional classroom by the same instructor. (Contains student evaluations of the course. (Author/DLS)

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Developing Courseware for Distance Learning— Any Place, Any Time

Thomas B. Barker, Associate Professor
The John D. Hromi Center for Quality and Applied Statistics
College of Engineering, Rochester Institute of Technology

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Abstract

There is a wide array of approaches that can and do produce materials (courseware) for the delivery of university level courses via the method now commonly known as "Distance Learning" (DL). DL has increasingly become a part of university systems across the United States and is expected to grow to 10% of enrollment at Rochester Institute of Technology (RIT) by the start of the next millennium. RIT has been a pioneer in the DL format with over 148 courses offered each year. With this expected growth of course offerings, a considerable amount of strain has begun to and will continue to take place on production support personnel and production facilities at RIT and elsewhere. This study supported by a "Provost Productivity Improvement" grant from RIT set out to produce courseware in an unconventional manner that would point the way to an approach that can be accomplished by faculty much in the same manner they produce course materials for conventional "live" classroom delivery. This paper will detail the effort that went into the planning, execution, and delivery of two courses in the graduate level MS/Certificate program in Applied Statistics in the College of Engineering at RIT. In addition, the educational effectiveness of these courses will be reported on by making statistical comparisons with parallel courses taught in the conventional live classroom by the same instructor. Student comments on the courses will also be included as part of the report.

Background

The Televised Classroom

Modern communication technology has negated the need for physical travel to accomplish distance learning objectives. RIT has in its DL offerings utilized VHS video tape to deliver lectures to the students. Video tape is inexpensive, easy to mail to students, and VCR's are in most homes making this delivery media nearly universal. Video tapes are produced in either of two modes. The presenter is simply recorded as he or she conducts an ordinary "live" class. This approach which is called "televised classroom" is usually done in a specially equipped "studio" type classroom on campus. Students are in the audience and some interaction is possible, although there is a bit of reluctance on the part of the students to participate because of the intimidating nature of the TV cameras. Therefore the lecture is a monologue for the most part, although with more planning and direction, this could be a lively approach to re-creating classroom dynamics that are not available to the DL student viewing a tape.

Classroom Television

The second approach to the video recording of the lecture is to place the instructor in a television studio. Visuals used in the class are prepared using any of the many presentation software packages such as Powerpoint® , Persuasion®, or Astound®. The visuals can be

IR018981

prepared by the instructor, or this service is offered by E.T.C. (RIT's Educational Technology Center). The visuals can be cut into the lecture either as the program is unfolding, or edited in later. Visuals that "unfold" are captured with a visualizer that is on the desk with the instructor. These may be cut in at the time of creation, or edited in later as with the computer generated visuals. This formal, studio production (sometimes called classroom television) has the advantage over the televised classroom in-as-much-as the instructor can call "cut" and re-do a sequence if a modification needs to be made. The E.T.C. television facility is the source of all video production for DL courses on the RIT campus. An example of a "big budget" classroom television production is the series Against All Odds produced through the American Statistical Association and funded by the Annenberg Foundation. Against All Odds is an overview series on the fundamentals of statistics and makes extensive use of interviews, on-location situations, and animated visuals all focused on effective communication and instruction.

Satellites: A Costly Delivery System

In the early days of DL, some televised classrooms were broadcast via satellite to the remote sites where a gathering of students watched synchronously with the live lecture on campus. However, the cost of the uplink and downlink is considerable and it is sometimes difficult to get all of the remote students to assemble at the same time. Therefore, the program was often recorded for viewing by those students who were unable to watch it synchronously. Rochester Institute of Technology did not choose to follow this method which is now recognized as a very expensive way of delivering the DL tapes and has all but been abandoned as the prime delivery approach by other institutions. Students also complained that the concept of "any time, any place" was violated by the satellite delivery method. Viewing the tape at the student's own pace and at the student's time of choice has evolved as the most common vehicle of lecture delivery.

The Web as a Communication Tool

During the 1997–98 academic year, RIT decided to put a strong emphasis on internet-based computer communication. FirstClass®, a conference software package was piloted in the summer quarter of 1996 with 3 courses and adopted university-wide in the summer quarter of 1997. First Class has a modern user interface with drop-down menus that have become familiar to most users of Windows 95 or the intuitive Macintosh systems. One feature of First Class is the "Chat Session" that allows the entire class to assemble much like a telephone conference call without the special equipment required for the phone system. It is a text based system only, and does lack graphical (drawing) capabilities. Attached files to First Class messages may be downloaded to be read in application programs as a workaround to the absence of graphics in this text-based communication package. For on-line, live chatting the use of attached files is not as convenient as having drawing capabilities in the chat session itself. This is especially true for technical subjects that rely on graphics to deliver an idea. Since RIT is a technical institution, this deficiency is being addressed to make First Class a more viable tool.

Developing Courseware—Any Place, Any Time

In keeping with the slogan of Distance Learning (any place, any time) and concerned that the E.T.C. video production facilities would become saturated with the planned increase in

course offerings, this author decided to approach the production of the video tape lectures in a different manner than was customary at RIT. Another reason stems from the competition in DL that is building from other universities across the country. RIT is not alone in recognizing that to maintain enrollment in an era of a declining student population, DL can make up for the drop in the on-campus student body. In such a competitive market, a superior product can attract more students.

Annenberg Approach as a Model

Using the Annenberg production of Against all Odds as a role model, a proposal for a Provost Productivity Grant was made to produce two one-quarter courses in the MS/Certificate program in Applied Statistics offered by the John D. Hromi Center for Quality and Applied Statistics which is a part of the College of Engineering at RIT. These courses, Design of Experiments I and Design of Experiments II are core courses in the MS program and required courses in the Certificate in Quality program. They are also attended by engineering and science students from other colleges at RIT. This author had taught these courses for over 25 years and is also the author of one of the text books for them. The author is also an active film/video maker with national awards for his film work. With this combination of experience, it was a natural fit to embark on the "do it yourself" approach to the video lecture production of the Design I & II courses. Work had already begun before the grant was approved since the time to produce a DL lecture series on tape could consume from 12 to 18 months as a full-time activity (1). The author was relieved from teaching one "live" course each quarter during the planning and production phases of this project.

The Scripting Process

Script approval. Another part of the non-traditional approach to the DL video production was the script approval process developed by the author. This is a three-stage approval process with the curriculum coordination committee acting as the reviewing body. The Design of Experiments Curriculum Committee acted as the reviewing group for the courses described in this paper.

Discovering efficient scripting. A story board format was adopted for the script writing phase of the DL video lecture project. A number of approaches to writing the script (the most lengthy part of the process) were tried. All of these approaches were centered on discovering the sequence of events in the preparation of materials for the video lecture that would be the most efficient. The least efficient way of writing the script was to do the actual writing first and then creating the visuals to match the script, followed by the student notes. This approach was tried for the first few lectures of the 801 (Design I) course. A typical segment required 37 hours to write the script, develop the visuals, and then assemble the student notes. A comparable segment that started with the student notes, followed with the joint script/visual development process took 23 hours. This is nearly a 40% improvement in efficiency. Also, since the script was developed along with the visuals, the timing of the visuals was more accurate thus speeding the editing process when the "talking head" lecturer is joined with the illustrative visuals to make the final tape. A video instruction tape has been made to illustrate the script writing process.

Developing the Visuals

Since the goal of this DL project was to produce "Annenberg Style" video on a shoestring budget, it was important to have visual illustrations that incorporated the meaning of the subject and at the same time bring it to life. Statistics is usually considered dull. Overcoming this conventional wisdom was the real challenge. One of the nitty-gritty aspects of the visuals involved the application software package used to generate them. While the most powerful way to produce animated visuals is from Macromedia Director® this package is very costly and takes a considerable amount of time and effort to master. Simpler graphic presentation software was preferred in this case. There were two popular presentation software packages available at the time this project was undertaken. PowerPoint® is the most common of these and Persuasion® is the other. Neither of these popular packages were used in favor of a package with exceptional animation capabilities and a time-line control that neither of the aforementioned programs possess. The program used to create the visuals is Astound®. Astound is also capable of exporting a single "slide" or the entire presentation as a QuickTime® movie. In the case of nonlinear video editing, this is a valuable time/quality saver since the visual does not need to be converted to an NTSC video signal from its digital state and then back to an analog output. It can be simply cut into the video during editing of the final video tape presentation.

Production Begins

In keeping with the slogan of Distance Learning (any place, any time) and concerned that the E.T.C. video production facilities would become saturated with the planned increase in course offerings, this author decided to approach the production of the video tape lectures in a different manner than was customary at RIT. With the scripts in hand and an array of audio and video equipment from the author's own inventory, production began. The first "shoots" were done in early September of 1996 since the location involved a farmer's field and a Maple tree fully-laden with seeds. Location shots were considered essential to break up the monotony of the usual "talking head" at a desk approach used by most lecturers who utilize the televised classroom. The locations also give the student a sense that the subject is not just an academic activity, but has real application and the person delivering the lecture has "been there" and can take the student there. This element of the location shots then adds to the competitiveness of the RIT DL product.

Shooting on Location

Shooting on location is probably no more complicated than shooting in the studio. The task can be completed without assistance. When shooting outside, select days with hazy sun rather than intense specular sunlight to avoid harsh shadows. Portable reflectors may be used to balance the lighting. The camera will most likely be powered with its own battery and extra fully charged batteries should be on hand. An external microphone with a direct wire connection is recommended rather than a wireless microphone which could pick up radio interference. For this production, a cue-card was mounted on the camera to keep the presenter's eyes focused on the lens and thus on the audience. Cue-cards were an integral part of the script and the card holder was designed to fit on the camera and accommodate the four scenes or cuts.

Video: The Tip of the Iceberg

While the video recorded lectures require a substantial investment in time, they have a relatively long (3–5 years) life if scripted and approved by the appropriate academic body. Another "if" is the stability of the course content. If the material comes from an established discipline (like the statistics material in the 801 and 802 courses) then the life of the recorded lectures is long. If the technology is emerging (like information technology) then the life of the video lectures is short. In either case, the ongoing effort in Distance Learning involves interfacing with the students in the education process. Without the vehicle of the live classroom such participation in the educational process could degenerate to nothing more than a "submit assignments and exams for correction" exercise similar to the correspondence school model advertised in magazines like Popular Mechanics. Major universities may not, do not, and will not follow such a simple model.

Using FirstClass

Chats. In the 801 scripts, references are made to "chat sessions" on a regular basis. For both courses, the chatting was done using a computer-driven approach and the FirstClass software supported by the Office of Distance Learning (ODL) at R.I.T. Chatting allows the professor to involve the class in the education process by offering stimulating topics that would be natural points of discussion during the lecture in a live class. The chats take place in the FirstClass chat room after the lecture has been viewed on tape. The chat room session also allows students to submit their own questions and comments for either discussion or an answer from the professor.

When to chat. Experienced instructors often can anticipate questions based on student inquiries from the past. Even in live classes, all questions do not arise and the professor usually offers them in the form of the question, ". . . you may ask why we divide by the number of observations . . ." or other phrasing that encourage class participation. Of course in a video the answer to such questions is not forthcoming from the student viewer, so the chat session serves as the asynchronous completion of this part of the educational process.

Scheduling chat sessions is contradictory to the advertised DL concept of "any time" although the student can be in "any place." This author established two chat session times on the same day. A late afternoon (3 PM) and a later evening (7:30 PM) session were almost 100% attended. The later session could accommodate students in western time zones who worked from their home computers. The earlier session was for students who were working from company computers as well as their home devices. If a student missed a chat, the text of the session was archived in a FirstClass message that was available for all to review if so desired. This archival storage of the classroom dialogue is an advantage of the on-line discussion not afforded by live class discussion. A typical chat session lasted from 1 to 2 hours depending on the need. Since the chat topics were sent out in advance of the actual chat session as a FirstClass message, the chat leader (the professor) could copy them from the message and paste them into chat dialogue box. This made the flow of the typed session easier. Since the same topics were covered in both sessions, it was possible to copy comments from the earlier session's archive and paste them into the later session keeping the level of information equal in both groups.

Evaluation

Student Testing

Testing was also accomplished via FirstClass. A quiz was posted in the class session and at first it was to be returned to a quiz folder with instructions not to read any other quiz in that folder belonging to another student on penalty of an F for that quiz. Later, ODL explained the use of a FirstClass tool called a drop box. This feature allows a message (like a quiz or exam) to be deposited in a folder much like a mailbox. The deposits may not be viewed by the depositors although they may have permission to see what is in the box to verify that their message got there. Another help in expediting the examination process is the use of the FirstClass "stationery" message. The quiz is created using the stationery form by the professor. The student opens the quiz and it becomes the fill in the blank form for his or her answers. It is automatically addressed to the drop box and sent there when the student is ready to deliver the exam. These automated features of the FirstClass system make the direct communication aspect of distance learning a smooth operation and simulates the live class feeling very nicely. This author felt he had managed to know the students by the end of the quarter in much the same way as in a live class.

Is the Learning the Same?

While DL is a challenge, is very much technology intensive, and is able to emulate the live classroom in certain ways; the real question is: "Do the students learn as well in the DL format as they do in a live class?" This author asked this question many time at faculty information meetings, during informational teleconferences held on the DL topic, and as a member of the R.I.T. Senate appointed Ad Hoc committee on Distance Learning (2). With very little in the form of statistical evidence concerning the effectiveness of the DL methodologies, it was time to gather the data to answer this question. Historical final grades from four prior years were compared to the DL final grades using ordinary statistical hypothesis test methods and no significant differences were found between these two samples for either course. Thus we may conclude that there is no difference in the learning between the DL format and the live format with regard to grades.

Student Evaluations of the Product

How do the students feel about the DL method? The student evaluations from the DL offering were comparable to similar student evaluations from live courses. In the question regarding the ability of the DL format to convey the learning, the students' replies tended toward learning more than in a traditional course rather than less. This is a very good indication of the effectiveness of the DL approach adopted in these courses. In a separate questionnaire devised by this author, the following four areas of particular interest to the approach taken in these two courses were investigated: Video Lecture; Chats; evaluation; and the project.

The video. The video was highly regarded (with a mean score of 8.2 out of 10). Of interest is the unanimous agreement that the video quality looked professional with regard to lighting, editing, etc.

Chats. Evaluation and chat sessions were next in overall score. These two activities were closely linked to the FirstClass software. While there were mixed reviews of the software,

the students agreed that the chats and the on-line delivery of examination materials worked and aided the learning process. They also suggest that more enhancements to the software can make these processes better.

Project. The project fared the worst of the four topics. A 6.8 average rating (although the standard deviation was also the highest [2.37] indicating a wide diversity in these ratings) would indicate that more work must be done to enhance the project portion of the course. Yet, there was unanimous agreement that the project enhanced understanding and was a valuable part of the class. It may have been that the project was a lot of a new kind of work and the low rating simply reflected this fact.

Summary

This author's personal feeling on the learning accomplished via distance methods is very positive. In the final exam, the oral question was answered by the DL students (via the voice phone connection) with as much ability and confidence as the hundreds of students from the live classes of the past. Distance Learning, if done right produces learning that lasts, any time, any place.

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Autobiographical Sketch

Thomas B. Barker is an associate professor in the College of Engineering at Rochester Institute of Technology. His areas of teaching include industrial experimental design, regression analysis, Taguchi Methods, and Statistical consulting. He has been heavily involved with distance learning for two years and is the chair of the faculty committee on distance learning in the Center for Quality and Applied Statistics. He is also a cinematographer and the winner of two CINE Eagle Awards for his work. He has a BS in Photographic Engineering and an MS in Applied Statistics from RIT.

Address: Rochester Institute of Technology
98 Lomb Memorial Drive
Rochester, NY 14623
Email: tbbeqa@rit.edu
Phone: (716) 475-6005
Fax: (716) 475-5959